WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Review on Human Immunodeficiency Virus

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ABSTRACT

HIV was first identified in humans in 1959 which was transferred from chimpanzees to human during hunting. The virus is transmitted to other organisms when they come in contact with various fluids of infected person. There are 2 subtypes of virus: HIV-1 and HIV-2 from which the HIV-1 is more common. The human immunodeficiency virus is a lent virus that causes HIV infection. One of the most global disease is HIV. Infection with HIV occurs by the transfer of blood, semen, vaginal fluid, breast milk. Within these bodily fluids, HIV is present as both free virus particles and virus within infected immune cells. HIV infects vital cells in the human immune system such as helper CD4 T cells, macrophages. HIV infection leads to low levels of T cells through a number of mechanisms, including pyroptosis of infected T cells. A current treatment available and given to treat HIV with the therapeutic strategies. As well as the preventive measure to be taken to prevent spreading of HIV virus.

Keywords: Human immunodeficiency Virus, Transmission, Stages of Infection , Symptoms.

1. INTRODUCTION

Clinically, HIV infection can appear in various forms. In general doctors would look for bodily signs that are associated with the disease. This is not defective because, statistics shows different presentations of HIV infection. There is a link between nutrition, age and loco motors disorders in HIV infected persons, particularly who are above 45 years with body mass index ≥ 25 kg/m2, are suggested to limit physical activities. Those people are less likely to have locomotors disorders. (1) Human immunodeficiency virus is a virus that targets and attacks the immune system of the human being , thus it alters the immune system and increases the risk of infections and disease. Without proper treatment the infection may increase and proceed to advance stage of disease called as AIDS. (2) Normally, our body has immune system that attack viruses and bacteria. Immune system has white blood cells which protect us from infections. White blood cells contain CD4+ cells which is also known as helper cells or T cells. A person who is infected will be able to develop. These infections take advantage of body's immune system. These infections cause several health problems and even lead to death of a person. HIV has inability to protect against diseases and count of CD4 cells also decreases in HIV.(3)

H-It infects only human beings and also transmitted between humans not from animals. It is not transmitted from bites of mosquitoes, bats or any other species.

I-The body has immune system whose function is to protect our body from germs, infections etc. But a person suffering from HIV has inability to fight against diseases. However, immune system becomes deficient.

V-Virus is a small, the simplest thing which is in inactive form outside the body and becomes active when it goes inside human body.(4)

2. STRUCTURE

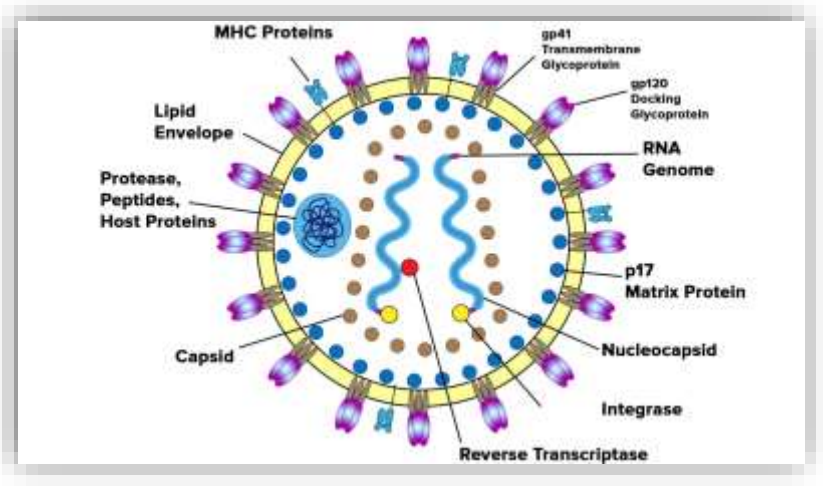

Fig.1.STRUCTURE OF HIV VIRUS (5)

2.1 Gp120:

The gp120 molecule of HIV-1 is a glycoprotein that is part of the outer layer of the virus. It presents itself as viral membrane spikes consisting of 3 molecules of gp120 linked together and anchored to the membrane by gp41 protein. Gp120 is essential for viral infection as it facilitates HIV entry into the host cell and this is its best-known and most researched role in HIV infection. However, it is becoming increasingly evident that gp120 might also be facilitating viral persistence and continuing HIV infection by influencing the T cell immune response to the virus. (6)

2.2 GP41:

It is a subunit of the envelope protein complex of retroviruses including human immuno- deficiencies virus. It is family of enveloped viruses that replicate in host cell through process of reverse transcriptase. It targets a host cell. Gp41 also known as glycoprotein 41 is a subunit of the envelope protein complex of human immunodeficiency virus (HIV). It is a transmembrane protein that contains several sites within its ectodomain that are required for infection of host cells and as a result it has received much attention as a potential target for HIV vaccines. Essentially, gp41 mediates fusion between viral and cellular membranes.(7)

2.3 Viral envelope:

It is envelope through which virus binds. P17 Viral core is made from protein. It is bullet shaped. Three enzymes required for HIV replication are reverse transcription, integrase and protease. (11)

2.4 P24:

Is component of HIV capsid. Gp41 also known as glycoprotein 41 is a subunit of the envelope protein complex of human immunodeficiency virus (HIV). It is a transmembrane protein that contains several sites within its ectodomain that are required for infection of host cells and as a result it has received much attention as a potential target for HIV vaccines. Essentially, gp41 mediates fusion between viral and cellular membranes. (8)

2.5 Protease:

It is a retroviral aspartyl protease that is essential for life cycle of HIV, the retrovirus that caused AIDS. This enzyme cleaves newly synthesized polyproteins at appropriate place to create nature protein components of infectious HIV virion. (11)

2.6 Integrase:

Enzyme produce by retrovirus that enables its genetic material to be integrated into the DNA of infected cell. The first antiviral drugs that target integrase, the viral enzyme that catalyzes DNA integration, have recently been approved and more are in the pipeline. These drugs bind to an intermediate in DNA integration called the intasome. in which a pair of viral DNA ends are synapsed by a tetramer of integrase, rather than free integrase enzyme.(9)

2.7 RNA:

All organisms including most viruses store their genetic material on long strands of DNA Retrovirus is exception because their genes are composed of RNA. Inside virions, HIV genomic RNA is found as a non-covalent dimer, is 5′ capped and 3′ polyadenylated, and is annealed to a host tRNALys3 molecule2. Viral proteins, especially nucleocapsid, chaperone folding of HIV RNA. (10)

3. LIFE CYCLE OF HIV

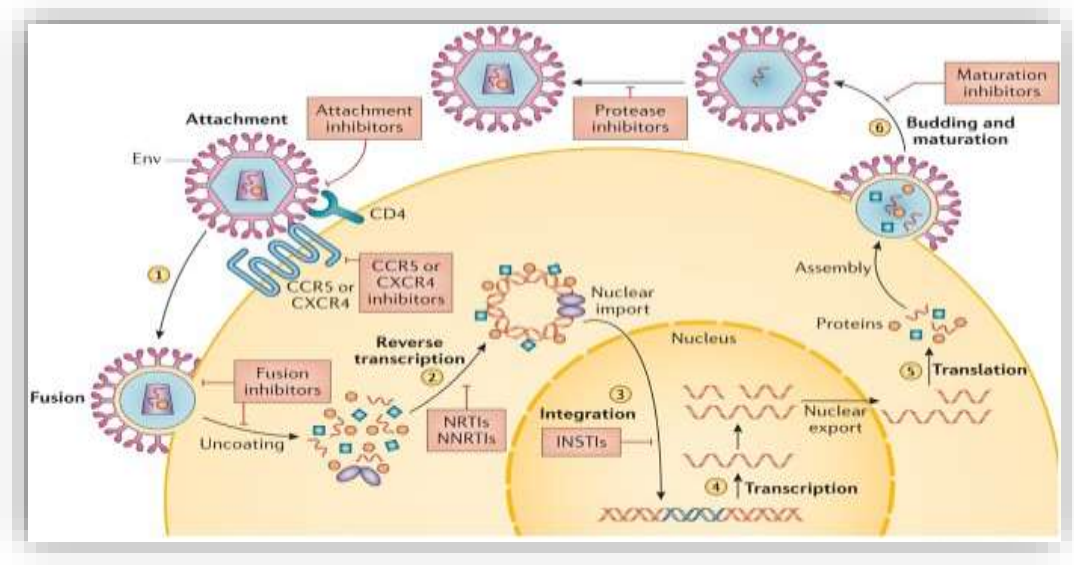

Fig.2.LIFE CYCLE OF HIV(12)

3.1 Binding:

During the first stage of HIV's life cycle, the virus binds to receptors on the surface of CD4 cells.

3.2 Fusion:

Once HIV binds to receptors on CD4 cells, it initiates the fusion of its envelope with the membrane of the CD4 cell using a glycoprotein called GP120Trusted Source. Glycoproteins are molecules made of chains of carbohydrates and proteins.Fusing with the membrane of your CD4 cells allows the virus to enter the cell.

3.3 Reverse transcription:

Reverse transcription is a process of converting genetic information in the form of RNA into DNA. RNA and DNA contain similar genetic information but are structurally different. RNA is typically made up of one long chain of genetic information, while DNA is made up of a double strand.

3.4 Integration:

Once HIV has converted its RNA into DNA, it then releases another enzyme called integrase inside the nucleus of your CD4 cell. The virus uses this enzyme to combine its DNA into the DNA of your CD4 cell.

3.5 Replication:

Because HIV is now integrated into your CD4 cell's DNA, it can use that cell's machinery to generate viral proteins. During this time, it can also produce more of its genetic material (RNA). These two things allow it to create more viral particles.

3.6 Assembly:

In the assembly stage, new HIV proteins and RNA are sent to the edge of your CD4 cell and become immature HIV. These viruses are non-infectious in their current form.

3.7 Budding:

During the budding stage, the immature viruses push out of your CD4 cell. They then release an enzyme called protease that modifies proteins in the virus and creates a mature and infectious version(13)

4. TRANSMISSION

You can get HIV only through certain activities. You cannot get HIV infection from touching an infected person, being in the same room as someone with HIV, or through contact with surfaces like toilet seats. (14)

• Certain body fluids, including semen, vaginal secretions, rectal fluids (through sexual contact with an infected person), and blood. These infected fluids have to either come in contact with mucous membranes or go directly into the bloodstream. In terms of HIV transmission, anal sex is the riskiest type of sexual activity. (15)

• Sharing needles or other equipment to inject drugs with someone who has HIV.

• Infected blood or blood products through transfusion. This is very rare in the United States but can happen in countries where blood and blood donors are not tested for HIV. Women with HIV infection can transmit the virus to their babies during pregnancy, at the time of birth, or through breastfeeding. HIV infection is not transmitted through saliva. (16)

5. STAGES OF INFECTION

There are 3 stages of infections and severity increases as the stage of disease increases. Stage 1 (Acute HIV infection) Stage 2 (Chronic infection) Stage 3 (Acquired immunodeficiency syndrome)

5.1 Stage 1:

Acute HIV Infection The earliest stage of infection is called as acute HIV, and generally develops within 2 to 4 weeks after the patient is infected with HIV virus. In this very first stage of infection, the virus multiplies and spreads rapidly throughout the body. The HIV starts to attack and destroy the infection-fighting CD4 cells. This gradually collapses the immune system. The risk of HIV transmission is increased in the acute stage because of high levels of HIV in blood.(17)

5.2 Stage 2:

Chronic HIV Infection This is the second stage of HIV infection also named as asymptomatic HIV or clinical latency. In this second stage of infection, the virus is in state of continuous multiplication but at very low levels. If the ART is not given to patient is this stage, the stage may advance to AIDS in about 10 years (may be more or less depending on immune system of patient).(18)

5.3 Stage 3:

AIDS The third stage is actually called AIDS and is the most severe stage of HIV infection. In this stage, the HIV has severely damaged the immune system and the body is unable to fight to the opportunistic infections. People with HIV are diagnosed with AIDS when their CD4 count is less than 200 cells/mm^3. Once the person is diagnosed with AIDS, they have a high viral load and can transmit disease to others very easily. Without treatment a person with AIDS typically survives for up to 3 years.(19)

6. SYMPTOMS

Symptoms of Disease Symptoms of the disease vary according to the stage of infection. Symptoms according to the stage of disease are mentioned below

6.1 Symptoms of Stage 1:

1. Headache
2. Fatigue
3. A red rash that doesn’t itch
4. Sore throat
5. Swollen lymph nodes

These symptoms are very similar to flu and are usually compared with it. The symptoms appears after 2-6 weeks after infection and vanishes after a week. If they are left untreated, the disease progresses to second stage.(20)

6.2 Symptoms of Stage 2:

After the person advances to the second stage of HIV infection, seroconversion process takes place and patient often feel better. In the second stage, patient may not show any other symptoms nearly for 10 years or even more (depending upon the health background of patient) But, the virus will still be active and continue to infect new cells of body. The virus also continues to replicate itself and risk of transmission is present during this stage. If ART is not given to patient overtime, HIV will continue to severely damage the immune system

6.3 Symptoms of Stage 3:

1. Being tired all the time
2. Fever that lasts for merely about 10 days
3. Night sweats
4. Weight loss with no obvious reasons
5. Shortness of breath
6. Severe long-lasting diarrhea
7. Purplish spots on your skin
8. Swollen lymph nodes in your neck and groin region
9. Yeast infections in your mouth, throat, vagina.(21)

7. DIAGNOSIS

HIV diagnostics have played a central role in the remarkable progress in identifying, stagin, initiating, and monitoring infected individuals on life-saving antiretroviral therapy. They are also useful in surveillance and outbreak responses, allowing for assessment of disease burden and identification of vulnerable populations and transmission “hot spots,” thus enabling planning, appropriate interventions, and allocation of appropriate funding. HIV diagnostics are critical in achieving epidemic control and require a hybrid of conventional laboratory-based diagnostic tests and new technologies, including point-of-care (POC) testing, to expand coverage, increase access, and positively impact patient management. In this review, we provide

(i) A historical perspective on the evolution of HIV diagnostics (serologic and molecular) and their interplay with WHO normative guidelines.

(ii) A description of the role of conventional and POC testing within the tiered laboratory diagnostic network.

(iii) Information on the evaluations and selection of appropriate diagnostics.

(iv) A description of the quality management systems needed to ensure reliability of testing.

(v) Strategies to increase access while reducing the time to return results to patients. Maintaining the central role of HIV diagnostics in programs requires periodic monitoring and optimization with quality assurance in order to inform adjustments or alignment to achieve epidemic control.(22)

8. TREATMENT

- There's no vaccine to save you HIV contamination and no treatment for AIDS. But you may guard yourself and others from contamination. To assist save you the unfold of HIV: Use remedy as prevention (TasP). If you are dwelling with HIV, taking HIV medicinal drug can preserve your accomplice from turning into inflamed with the virus.(23)
- Antiretroviral drugs are used to treat HIV. These are the drugs active against human immunodeficiency virus (HIV) which is a retrovirus. They are useful in prolonging and improving a quality of life. Antiretroviral drugs are classified as following
- Nucleoside reverse transcriptase inhibitors (NRTIs): Zidovudine (AZT), Didanosine , Lamivudine, Tenofovir. Nonnucleoside reverse transcriptase inhibitors: Nevirapine, Delavirdine, Efavirenz. Protease inhibitors: Indinavir, Nelfinavir, Amprenavir, Lopinavir, Atazanavir.
- Nucleoside analogue reverse transcriptase inhibitors (NRTIs) were the first type of drug available to treat HIV infection in 1987. When HIV infects a cell, it copies its own genetic code into the cell’s DNA, and the cell is then programmed to create new copies of HIV. To reproduce, HIV must first convert its RNA into DNA using the enzyme reverse transcriptase. These inhibitors act like false building blocks and compete with the cell’s nucleosides, thereby preventing DNA synthesis.

- Non-nucleoside reverse transcriptase inhibitors (NNRTIs) started to be approved in 1997. These also interfere with HIV's ability to infect cells by targeting reverse transcriptase. In contrast to nucleoside analogue reverse transcriptase inhibitors, non-nucleosides bind directly to the enzyme. (24)
- HAART It is highly active antiretroviral therapy. HIV can also be treated by HAART. It is a combination of three drugs. (25)

CONCLUSION

The HIV viral life cycle and the host response to viral (infection) is comprehensive which results that the virus specific intervention have developed which is highly active that may contain viral replication. The damaged immune system (infected by the HIV virus) can be at least partially immune reconstituted and those individuals with the last stage of infection can have expectation for long survival if they are properly treated with Anti retro viral drugs.

Having HIV helped people to think about the value of life now: 'Once you realize your mortality, then that focuses your life to do things that you want to do, as opposed to doing things to survive.' In other words, people started to think about their present quality of life. Focusing on 'now' had all sorts of implications for people. These included taking responsibility for their lives, doing things that were good for them, making choices to look after themselves and enjoying life: 'So don't dwell on the future, live in the present, enjoy it and act responsibly so that the future will hold better things for you' was how one person saw it. Another said, 'The future depends on how I live today.'

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